

## CLAIMS

### WHAT IS CLAIMED IS:

1. An apparatus for the production of fatty acid alkyl ester comprising:
  - a first tank containing naturally occurring fatty acids;
  - a second tank containing an alkaline solution;
  - a third tank containing an alcohol;
  - a reaction chamber for the transesterification of an emulsion;
  - a natural gravity separatory; and
  - a centrifuge.
2. The apparatus of Claim 1, wherein said naturally occurring fatty acids are animal fats.
3. The apparatus of Claim 1, wherein said naturally occurring fatty acids are vegetable oils.
4. The apparatus of Claim 1, wherein said alkaline solution is a concentrated form of one of the group comprising sodium hydroxide, potassium hydroxide, sodium methoxide, potassium methoxide, or other strong mineral alkaline solutions.
5. The apparatus of Claim 1, wherein said alcohol is one of the group comprising methanol, ethanol, propanol, and other monoalkyl alcohols.

6. The apparatus of Claim 1 wherein said emulsion is a combination of said naturally occurring fatty acids, said alkaline solution and said alcohol.
7. The apparatus of Claim 6, wherein said emulsion is transesterified in said reaction chamber.
8. The apparatus of Claim 7, wherein said reaction chamber comprises:
  - a first inlet for the introduction of said emulsion;
  - a first outlet for the removal of a transesterified version of said emulsion;
  - a cooling jacket containing a pump fed flow of a cooling liquid for maintaining said reactor chamber at a defined temperature; and
  - a horn.
9. The apparatus of Claim 8, wherein said horn enhances the transesterification of said emulsion using ultrasonic irradiation.
10. The apparatus of Claim 9, wherein said horn ultrasonically irradiates said emulsion at specific frequencies of between generally about 20 kHz and generally about 50 KHz.
11. The apparatus of Claim 9, wherein said horn operates at power densities of between generally about 18 Ws/ml and generally about 65 Ws/ml.

12. The apparatus of Claim 8, wherein said reaction chamber is maintained at an operating temperature of between generally about 70°C and generally about 80°C and an operating pressure of between generally about 1.0 and generally about 5.0 atmospheres.

13. The apparatus of Claim 7, wherein said natural gravity separation operates to separate said transesterified emulsion into a glycerol solution and fatty acid alkyl ester.

14. The apparatus of Claim 13, wherein said fatty acid alkyl ester is introduced into said centrifuge for washing and drying, wherein said washing and drying involves the removal of traces of the catalyst, residual alcohol, and any remaining glycerol, soaps, and excess water.

15. The apparatus of Claim 14, wherein said washed and dried fatty acid alkyl ester is a pure biodiesel fuel requiring no additional processing to meet the ASTM standard for biodiesel.

16. A method for the production of fatty acid alkyl ester comprising the steps of:

a) providing an emulsion of naturally occurring fatty acids, an alkaline solution and an alcohol;

b) ultrasonically irradiating said emulsion to enhance the transesterification process;

c) separating said transesterified emulsion into a glycerol solution and fatty acid alkyl ester using a natural gravity separatory; and

d) washing and drying said fatty acid alkyl ester in a centrifuge to remove any remaining catalyst, alcohol, glycerol, soaps, and excess water.

17. The method of Claim 16, wherein said naturally occurring fatty acids are animal fats.

18. The method of Claim 16, wherein said naturally occurring fatty acids are vegetable oils.

19. The method of Claim 16, wherein said alkaline solution is a concentrated form of one of the group comprising sodium hydroxide, potassium hydroxide, sodium methoxide, potassium methoxide, or other strong mineral alkaline solutions.

20. The method of Claim 16, wherein said alcohol is one of the group comprising methanol, ethanol, propanol, and other monoalkyl alcohols.

21. The method of Claim 16, wherein said transesterification of said emulsion occurs in a reaction chamber, and wherein said reaction chamber comprises a horn.

22. The method of Claim 21, wherein said horn ultrasonically irradiates said emulsion at frequencies between generally about 20 kHz to generally about 50 kHz.

23. The method of Claim 21, wherein said horn operates at power densities of between generally about 18 Ws/ml and generally about 65 Ws/ml.

24. The method of Claim 21, wherein said reaction chamber is maintained at a specific temperature of between generally about 70°C and generally about 80°C and an operating pressure of between generally about 1.0 and generally about 5.0 atmospheres.

25. A method for the production of fatty acid alkyl ester comprising the steps of:

- a) providing a naturally occurring fatty acid;
- b) providing an alkaline solution;
- c) providing an alcohol;
- d) emulsifying said naturally occurring fatty acid, said alkaline solution and said alcohol;
- e) transesterifying said emulsion at controlled temperatures and pressures;
- f) gravitationally separating said transesterified emulsion into a glycerine solution and fatty acid alkyl ester; and
- g) washing and drying said fatty acid alkyl ester in a centrifuge to remove

any remaining catalyst, residual alcohol, glycerol, soaps, and excess water.

26. The method of Claim 25, wherein said naturally occurring fatty acids are animal fats.

27. The method of Claim 25, wherein said naturally occurring fatty acids are vegetable oils.

28. The method of Claim 25, wherein said alkaline solution is a concentrated form of one of the group comprising sodium hydroxide, potassium hydroxide, sodium methoxide, potassium methoxide, or other strong mineral alkaline solutions.

29. The method of Claim 25, wherein said alcohol is one of the group comprising methanol, ethanol, propanol, and other monoalkyl alcohols.

30. The method of Claim 25, wherein said transesterification of said emulsion occurs in a reaction chamber.

31. The method of Claim 30, wherein said transesterification occurs at a specific temperature of between generally about 70°C and generally about 80°C and an operating pressure of between generally about 1.0 and generally about 5.0 atmospheres.

32. The method of Claim 25, wherein said gravitationally separated fatty acid alkyl ester is washed in said centrifuge using a solution of warm, deionized water.

33. The apparatus of Claim 5, wherein between generally about 0% to generally about 2.4% stoichiometric requirements per weight of said naturally occurring fatty acid is used in said production.

34. The method of Claim 20, wherein between generally about 0% to generally about 2.4% stoichiometric requirements per weight of said naturally occurring fatty acid is used in said production.

35. The method of Claim 29, wherein between generally about 0% to generally about 2.4% stoichiometric requirements per weight of said naturally occurring fatty acid is used in said production.